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Langley Research Center
Hampton, Virginia 23681-0001

Julia Cole
(757) 864-4052

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Chris Rink
(757) 864-6786

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25 YEARS OF ATMOSPHERIC SCIENCES AT LANGLEY

Celebrating Earth Day with research accomplishments

To commemorate Earth Day, Atmospheric Sciences at NASA Langley, marking its twenty-fifth anniversary as a major field of study this year, highlights research contributions that ultimately have increased the awareness of how human activities impact the atmosphere.

After a quarter century of investigating atmospheric processes from the air, land, sea and space, NASA Langley researchers have developed new technologies and made scientific discoveries that revolutionized how scientists study and understand Earth's atmosphere. A list of accomplishments and new research of Langley's major space-based instruments and multi-platform field experiments follows:

- **A First in Atmospheric Sensing**
  Langley researchers were the first to develop and operate a space-based atmospheric LIDAR (Light Detection and Ranging – an atmospheric sensing instrument). The Lidar In-Space Technology Experiment (LITE) instrument was flown on the Space Shuttle Discovery in 1994, proving that space-based lidar measurements could offer invaluable data unavailable by other means. Among the many accomplishments of LITE, these data provided the first highly detailed global view of the vertical structure of cloud and aerosols from the Earth's surface through the middle stratosphere as well as sensitive observations of the distribution of dust, smoke and other aerosols. The success of the LITE instrument paved the way for a new lidar-based satellite, Pathfinder Instruments For Cloud and Aerosol Spaceborne Observations—Climatologie Etendue des Nuages et des Aerosols (PICASSO-CENA), developed by Langley researchers that is scheduled to launch in 2004.

- **Documenting Environmental Progress**
  September 2001 marks the HALOE (Halogen Occultation Experiment) instrument's tenth year in orbit aboard the Upper Atmosphere Research Satellite with flawless operation. After a decade of measuring ozone and trace gases in the upper atmosphere, HALOE tells an environmental success story. It is the only space-based instrument that monitored the reduction and leveling off of chlorine in the stratosphere due to reduced chlorofluorocarbon (CFC) production. HALOE has also improved the understanding of ozone depletion in the stratosphere.

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- **Monitoring Volcanic Eruptions and Ozone**
  The Stratospheric Aerosol and Gas Experiment II (SAGE II) mission has monitored aerosol, ozone and other trace gases from space since 1984. A major contribution of this instrument is the long record of ozone data it has provided. These data have proven to be an invaluable asset to the United Nations Environment Program for assessing ozone trends. Other SAGE II data gave researchers a better understanding of the influence human activities have on aerosols in the atmosphere as well as the long-term global climatic effects of the 1991 Mt. Pinatubo volcanic eruption. The SAGE III mission will build upon the success of SAGE II with a launch scheduled during 2001.

- **Understanding the Earth's Lower Atmosphere**
  Tropospheric processes have wide-ranging effects within the atmosphere, so a detailed understanding of these is essential for an accurate picture of global climate change. So important is the understanding of these processes that the National Academy of Sciences established the Global Tropospheric Chemistry Program on behalf of the United States' effort in an international research program designed to study the troposphere. The Global Tropospheric Experiment (GTE), managed by Langley, is NASA's contribution to this project.

  The GTE is a program of aircraft-based experiments dedicated to improving the knowledge of global tropospheric chemistry and its implications for the biosphere, climate, and stratosphere. Past GTE missions provided measurements about ozone production and loss in the remote troposphere, a baseline against which to measure future pollution impacts on the troposphere, and new information for climate models. The latest GTE mission, the Transport and Chemical Evolution over the Pacific (TRACE-P) experiment, is currently taking place in the western Pacific off the coast of Asia and will study the impact of a major industrial revolution on the composition and chemistry of the atmosphere.

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